

The documentation and process conversion measures necessary to comply with this revision shall be completed by 27 May 2016.

INCH-POUND

MIL-PRF-19500/644B
26 February 2016
SUPERSEDING
MIL-PRF-19500/644A
16 August 1998

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, DUAL,
COMMON CATHODE OR ANODE CENTER TAP, ULTRAFAST, THROUGH HOLE MOUNT PACKAGE,
TYPES 1N6768 THROUGH 1N6771, QUALITY LEVELS JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments
and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of
this specification sheet and [MIL-PRF-19500](#).

1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, dual ultrafast, power rectifier diodes in a common center-tap configuration. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each device type as specified in [MIL-PRF-19500](#).

1.2 Package outlines. The device package outline is a TO-257AA (isolated) in accordance with [figure 1](#) for all encapsulated device types.

1.3 Maximum ratings. Unless otherwise specified, $T_A = +25^\circ\text{C}$.

Types	V_{RWM} 1/ $I_D = 5 \mu\text{A dc}$	I_F 1/ 2/ $T_C = +100^\circ\text{C}$	I_{FSM} 1/ $t_p = 8.3\text{ms}$	$R_{\theta JC}$ 1/	$R_{\theta JA}$ 1/	T_{STG} and T_{OP}
	<u>V dc</u>	<u>A dc</u>	<u>A (pk)</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C</u>
1N6768	50	8.0	60	3.8	45	-65 to +150
1N6769	100					
1N6770	150					
1N6771	200					

1/ Each individual diode.

2/ Derate at 160 mA/°C above $T_C = +100^\circ\text{C}$.

1.4 Primary electrical characteristics. Unless otherwise specified $T_C = +25^\circ\text{C}$, for each diode in the package.

Types	V_{F1} $I_F = 4 \text{ A dc}$	V_{F2} $I_F = 8 \text{ A dc}$	I_{R1} $V_R = 0.8 V_{RWM}$ (See 1.3)	I_{R2} $V_R = 0.8 V_{RWM}$ (See 1.3) $T_C = +100^\circ\text{C}$	t_{rr}	C_J $V_R = 5 \text{ V}$ $f = 1 \text{ MHz}$
	<u>V dc</u>	<u>V dc</u>	<u>$\mu\text{A dc}$</u>	<u>$\mu\text{A dc}$</u>	<u>ns</u>	<u>pF</u>
All types	0.97	1.06	10	250	35	150

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

AMSC N/A

FSC 5961



1.5 Part or Identifying Number (PIN). The PIN is in accordance with [MIL-PRF-19500](#), and as specified herein. See [6.4](#) for PIN construction example and [6.5](#) for a list of available PINs.

1.5.1 JAN certification mark and quality level. The quality level designators for encapsulated devices that are applicable for this specification sheet are "JAN", "JANTX", "JANTXV", and "JANS".

1.5.2 Device type. The designation system for the device types of diodes covered by this specification sheet are as follows.

1.5.2.1 First number and first letter symbols. The diodes of this specification sheet use the first number and letter symbols "1N".

1.5.2.2 Second number symbols. The second number symbols for the diodes covered by this specification sheet are "6768", "6769", "6770", and "6771".

1.5.3 Suffix symbols. Devices without a suffix symbol are of the common cathode configuration. The suffix symbol "R" is included in the PIN for devices of the common anode configuration (see [figure 1](#)).

1.5.4 Lead finish. The lead finishes applicable to this specification sheet are listed on [QPDSIS-19500](#).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections [3](#) and [4](#) of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections [3](#) and [4](#) of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation (see [6.2](#)).

DEPARTMENT OF DEFENSE SPECIFICATIONS

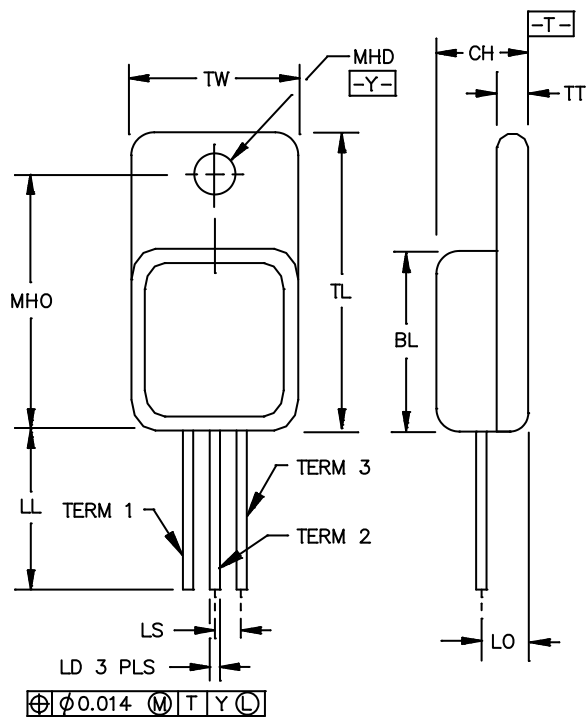
[MIL-PRF-19500](#) – Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-750](#) – Test Methods for Semiconductor Devices.

(Copies of these documents are available online at <http://quicksearch.dla.mil>.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



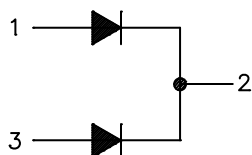
Dimensions				
Symbol	Inches		Millimeters	
	Min	Max	Min	Max
BL	.410	.430	10.4	10.9
CH	.190	.200	4.82	5.10
LD	.025	.035	0.64	0.89
LL	.500	.750	12.70	19.05
LO	.120 typ		3.05 typ	
LS	.100 bsc		2.54 bsc	
MHD	.140	.150	3.55	3.80
MHO	.527	.537	13.4	13.6
TL	.645	.665	16.4	16.9
TT	.035	.045	0.90	1.15
TW	.410	.420	10.4	10.7

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. All terminals are isolated from case.
3. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

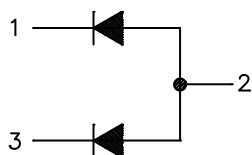
SCHEMATIC

1N6768, 1N6769, 1N6770, 1N6771



Terminal	Description
1	Anode 1
2	Cathode
3	Anode 2

1N6768R, 1N6769R, 1N6770R, 1N6771R



Terminal	Description
1	Cathode 1
2	Anode
3	Cathode 2

FIGURE 1. Physical dimensions and configuration (TO-257AA).

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in [MIL-PRF-19500](#) and as specified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see [4.2](#) and [6.3](#)).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in [MIL-PRF-19500](#).

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in [MIL-PRF-19500](#) and on [figure 1](#) herein. Methods used for electrical isolation of the terminal feedthroughs shall employ materials that contain a minimum of 90 percent Al₂O₃ (ceramic). Examples of such construction techniques are metallized ceramic eyelets or ceramic walled packages.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with [MIL-PRF-19500](#), [MIL-STD-750](#), and herein. Where a choice of lead finish or formation is desired, it shall be specified in the acquisition document (see [6.2](#)).

3.4.2 Lead formation. When lead formation is performed, as a minimum, the vendor shall perform 100 percent hermetic seal in accordance with screen 14 of table E-IV of [MIL-PRF-19500](#) and 100 percent DC testing in accordance with [table I](#) subgroup 2 herein.

3.4.3 Polarity. Polarity and terminal configuration shall be in accordance with [figure 1](#) herein.

3.5 Marking. Marking shall be in accordance with [MIL-PRF-19500](#).

3.6 Electrical performance characteristics. Unless otherwise specified, the electrical performance characteristics are as specified in [1.3](#), [1.4](#), and [table I](#) herein.

3.7 Workmanship. Devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of Inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see [4.2](#)).
- b. Screening (see [4.3](#))
- c. Conformance inspection (see [4.4](#)).

4.2 Qualification inspection. Qualification inspection shall be in accordance with [MIL-PRF-19500](#) and as specified herein.

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of [table III](#) tests, the tests specified in [table III](#) herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.3 Screening (quality levels JANTX, JANTXV, and JANS). Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen	Measurement	
	Quality level JANS	Quality levels JANTX and JANTXV
3c (1)	Thermal impedance (see 4.3.2)	Thermal impedance (see 4.3.2)
9 and 10	Not applicable	Not applicable
11	I_{R1} and V_{F2}	I_{R1} and V_{F2}
12	See 4.3.1, $t = 240$ hours	See 4.3.1, $t = 48$ hours
13	Subgroups 2 and 3 of table I herein	Subgroup 2 of table I herein

- (1) Thermal impedance shall be performed any time after temperature cycling, screen 3a, and does not need to be repeated in screening requirements (for JANTX and JANTXV quality level devices only).

4.3.1 Power burn-in conditions. Power burn-in conditions shall be as follows:

Test condition A of method 1038 of MIL-STD-750. $T_C = +125^\circ\text{C}$; $V_R = 0.8$ of rated V_{RWM} (see 1.3).

4.3.2 Thermal impedance ($Z_{\theta JX}$) measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750. Test each die separately. The maximum limit (not to exceed the table I, subgroup 2 limit) and conditions for $Z_{\theta JX}$ in screening (table E-IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable X, R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for Engineering evaluation and disposition.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with 4.4.2.1 for quality level JANS or 4.4.2.2 for quality levels JAN, JANTX, and JANTXV.

4.4.2.1 Quality level JANS. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIA of MIL-PRF-19500 and herein. Delta measurements shall be in accordance with table II herein.

Subgroup	Method	Condition
B4	1037	I_F or $I_O = 1.25$ A to 8 A; $\Delta T_J = +85^\circ\text{C}$ minimum.

4.4.2.2 Quality levels JAN, JANTX, and JANTXV. Group B inspection shall be conducted in accordance with the conditions specified in table E-VIB of MIL-PRF-19500 and herein. Delta measurements shall be in accordance table II herein.

Subgroup	Method	Condition
B3	1037	I_F or $I_O = 1.25$ A to 8 A; $\Delta T_J = +85^\circ\text{C}$ minimum, for 2,000 cycles minimum.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500 and as follows. Delta measurements shall be in accordance with the applicable steps of table II herein.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition A, 5 pounds (2.27 Kg), $t = 15$ seconds ± 3 seconds.
C6	1037	I_F or $I_O = 1.25$ A to 8 A; $\Delta T_J = +85^\circ\text{C}$ minimum, for 6,000 cycles minimum.

4.4.4 Group E Inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified in table III herein. Delta measurements shall be in accordance with the applicable steps and footnotes of table II herein.

4.5 Method of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal impedance ($Z_{\theta JX}$) measurements.

4.5.2.1 Initial qualification or requalification. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750 (read and record data $Z_{\theta JX}$). The derived conditions limits and thermal response curve shall be supplied to the qualifying activity on the qualification lot prior to qualification approval.

4.5.2.2 Group A inspection. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750. The following test conditions shall be used:

- a. I_M measure current ----- 15 mA
- b. I_H forward heating current ----- 9.9 A
- c. t_H heating time ----- 200 ms
- d. t_{MD} measurement delay time ----- 35 ms
- e. V_H heating voltage ----- 1 V

The maximum limit for $Z_{\theta JX}$ under these conditions are $Z_{\theta JX(max)} = 3.6^\circ\text{C/W}$.

4.5.3 Thermal resistance ($R_{\theta JC}$). Thermal resistance measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum limits for $R_{\theta JC(max)}$ shall be 3.8°C/W for devices in the TO-257AA case style. Each diode leg shall be measured. The following parameter measurements shall apply:

- a. I_M measure current -----15 mA
- b. I_H forward heating current-----9.9 A
- c. t_H heating time -----Steady state (see method 3101 of MIL-STD-750)
- d. t_{MD} measurement delay time -----35 μs
- e. V_H heating voltage -----1 V

TABLE I. Group A inspection. [1/](#) [2/](#)

Inspection	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Thermal impedance 3/	3101	See 4.5.2.2	$Z_{\theta JX}$		3.6	°C/W
Breakdown voltage 1N6768, 1N6768R	4022	$I_R = 5 \mu A$ dc, pulsed 4/	V_{BR}	50		V dc
1N6769, 1N6769R				100		
1N6770, 1N6770R				150		
1N6771, 1N6771R				200		
Forward voltage	4011	Condition B; $I_F = 4 A$ dc, pulsed 4/ $I_F = 8 A$ dc, pulsed 4/	V_{F1} V_{F2}		0.97 1.06	V dc V dc
Reverse leakage current	4016	DC method; pulsed 4/ $V_R = 0.8$ of V_{RWM} (see 1.3)	I_{R1}		10	μA dc
<u>Subgroup 3</u>						
High temperature operation:		$T_C = +100^{\circ}C$				
Reverse leakage current	4016	DC method; pulsed 4/ $V_R = 0.8$ of V_{RWM} (see 1.3)	I_{R2}		250	μA dc
Low temperature operation:		$T_A = -55^{\circ}C$				
Forward voltage	4011	Condition B; $I_F = 8 A$ dc, pulsed 4/	V_{F3}		1.17	V dc
<u>Subgroup 4</u>						
Scope display evaluation 5/	4023					
Reverse recovery time measurements	4031	Condition B1; $I_F = 1.0 A$, $di/dt = 50 A/\mu s$	t_{rr}		35	ns
<u>Subgroups 5 and 6</u>						
Not applicable						
<u>Subgroup 7</u>						
Junction capacitance	4001	$V_R = 5 V$ dc; $f = 1.0 MHz$	C_J		150	pF

See footnotes at end of table.

TABLE I. Group A inspection – Continued.

- 1/ For sampling plan, see [MIL-PRF-19500](#).
2/ Each individual diode.
3/ This test required for the following electrical measurements only:
 Group B, subgroups 3, 4 and 5 (JANS).
 Group B, subgroups 2 and 3 (JAN, JANTX, JANTXV).
 Group C, subgroups 2 and 6.
 Group E, subgroup 1.
4/ Pulse test: Pulse width = 300 μ s, duty cycle \leq 2 percent.
5/ The reverse breakdown characteristics shall be viewed on an oscilloscope with display calibration factors of 2 to 5 μ A/division and 20 to 50 V/division. Reverse current over the knee shall be at least 20 μ A. Each device may exhibit a slightly rounded characteristic and any discontinuity or dynamic instability of the trace shall be cause for rejection.

TABLE II. Groups B, C, and E electrical and delta measurements. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1	Forward voltage	4011	(see 1.3) DC method, pulsed Condition B; $I_F = 8$ A dc pulsed	ΔV_{F2}		± 100 mV dc from initial reading	
2	Reverse leakage current	4016	DC method; $V_R = 0.8$ of V_{RWM} (see 1.3) pulsed	ΔI_{R1}		100 percent of initial value or ± 2.5 μ A dc whichever is greater.	

- 1/ The measurements for group B inspection for quality level JANS only are as follows:
 a. In addition to the measurements specified for subgroup 4 of table E–VIA of [MIL-PRF-19500](#), the measurements of all steps of this table shall also be taken.
 b. In addition to the measurements specified for subgroup 5 of table E–VIA of [MIL-PRF-19500](#), the measurements of all steps of this table shall also be taken.
2/ The measurements for group C inspection for quality level JANS only are as follows: In addition to the measurements specified for subgroup 6 of table E–VII of [MIL-PRF-19500](#), the measurements of steps 1 and 2 of this table shall also be taken.
3/ The measurements for group E inspection, all product assurance levels, shall be as follows: In addition to the measurements specified for subgroups 1 and 2 of table E–IX of [MIL-PRF-19500](#), the measurements of all steps of this table shall also be taken.

TABLE III. Group E inspection (all quality levels) for qualification and requalification only. 1/

Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling (air to air)	1051		
Hermetic seal	1071		
Fine leak			
Gross leak			
Electrical measurements		See table II herein, steps 1 and 2.	
<u>Subgroup 2</u>			45 devices c = 0
Steady-state reverse bias	1038	Test condition A t = 1,000 hours, T _C = +125°C V _R = 0.8 of rated V _{RWM} (see 1.3)	
Electrical measurements		See table II herein, steps 1 and 2.	
<u>Subgroup 4</u>			
Thermal impedance curves		See MIL-PRF-19500 .	
<u>Subgroup 5</u>			
Not applicable			

1/ For initial design and process change verification only (one time testing).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see [6.2](#)). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in [MIL-PRF-19500](#) are applicable to this specification.)

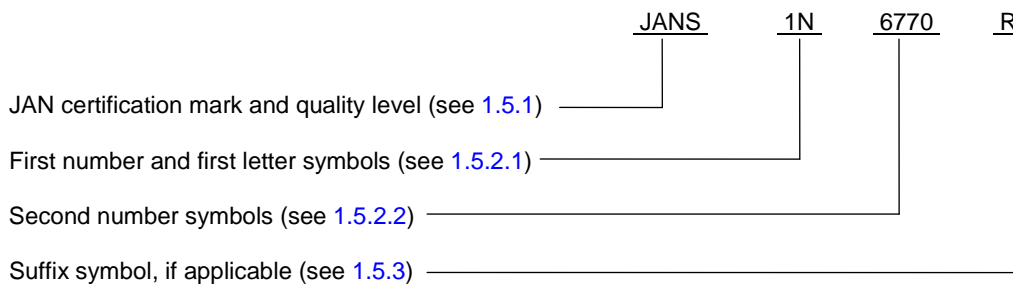
6.1 Intended use. Devices conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (3.4.1).
- d. The complete PIN, see 1.5 and 6.4.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers' List (QML) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43216-5000 or e-mail vqe.chief@dla.mil.

6.4 PIN construction example. The PINs for encapsulated devices are constructed using the following form.



6.5 List of PINs. The following is a list of possible PINs available for devices covered by this specification sheet.

JAN1N6768	JANTX1N6768	JANTXV1N6768	JANS1N6768
JAN1N6769	JANTX1N6769	JANTXV1N6769	JANS1N6769
JAN1N6770	JANTX1N6770	JANTXV1N6770	JANS1N6770
JAN1N6771	JANTX1N6771	JANTXV1N6771	JANS1N6771
JAN1N6768R	JANTX1N6768R	JANTXV1N6768R	JANS1N6768R
JAN1N6769R	JANTX1N6769R	JANTXV1N6769R	JANS1N6769R
JAN1N6770R	JANTX1N6770R	JANTXV1N6770R	JANS1N6770R
JAN1N6771R	JANTX1N6771R	JANTXV1N6771R	JANS1N6771R

6.6 Cross reference list. Parts covered by this specification may be used to replace the following commercial part numbers:

Preferred types	Commercial types
JAN1N6768, JAN1N6768R JANTX1N6768, JANTX1N6768R JANTXV1N6768, JANTXV1N6768R JANS1N6768, JANS1N6768R	1N6768, 1N6768R
JAN1N6769, JAN1N6769R JANTX1N6769, JANTX1N6769R JANTXV1N6769, JANTXV1N6769R JANS1N6769, JANS1N6769R	1N6769, 1N6769R
JAN1N6770, JAN1N6770R JANTX1N6770, JANTX1N6770R JANTXV1N6770, JANTXV1N6770R JANS1N6770, JANS1N6770R	1N6770, 1N6770R
JAN1N6771, JAN1N6771R JANTX1N6771, JANTX1N6771R JANTXV1N6771, JANTXV1N6771R JANS1N6771, JANS1N6771R	1N6771, 1N6771R

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
 Army – CR
 Navy – EC
 Air Force – 85
 NASA – NA
 DLA – CC

Preparing activity:
 DLA – CC

(Project 5961-2016-020)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.